Name of the module (English): New Trends for Construction Development and Research					
Module code (UP): M33 (provisional)		**Name of the module (Portuguese):** Novas Tendências para a Investigação e Desenvolvimento na Construção			
Module code (THM): IMTM (provisional)		**Name of the module (German):** Neue Trends in der Bauforschung und -entwicklung			
Module code (UC): M33 (provisional)		**Name of the module (Spanish):** Nuevas tendencias para la investigación y el desarrollo de la construcción			
Credits: 6 ECTS	**Module status:** Obligatory	**Duration:** 1 semester	**Semester:** 2	**Year:** 1	**Frequency:** Every year
Type of tuition: Classroom-based		**Workload:** 180 h	**Attendance time:** 60 h	**Self-study time:** 120 h	
Usability: Master (Degree in Sustainable Design, Construction and Management of the Built Environment)			**Classification:** Engineering / Architecture	**Teaching language:** English	
Module responsibility: Elena Blanco Fernández (UC)		**Lecturers:** José Manuel Marques Amorim de Araújo Faria (FEUP) Christian Karl Baier (THM)			

Description / Observations:
The syllabus has been developed in order to follow the same structure as the learning outcomes. Therefore, each line of contents in the syllabus will provide enough tools for the students to be able to reach the learning outcomes by attending to the theoretical hours and by doing the planned exercises/workshops/coursework.

Recommended Requirements:
Basic knowledge about sustainable concepts in design, construction and managements of buildings and infrastructures.

Basic competences:

- Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.
- Students are able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
- Students are able to integrate knowledge and deal with the complexity of making judgments based on information that is incomplete or limited, including reflections on the social and ethical responsibilities associated with applying their knowledge and judgments.
- Students are able to communicate their findings and the ultimate knowledge and reasons behind them to specialist and non-specialist audiences in a clear and unambiguous manner.
- Students possess the learning skills to enable them to continue studying in a largely self-directed or autonomous manner.

Transverse competences:
The practical exercises/workshops that will be proposed as an assessment method during class will try to reproduce as much as closer a possible ‘real life scenario’ case study. By using the knowledge acquired in the theoretical part of the classes, and by applying them to solve the practical exercises/workshops/courseworks, it will be ensured that students will be able to achieve the learning outcomes in an efficient way.

Specific competences:
Be able to develop a research proposal analyzing possible areas of development within sustainable design and construction as well as BIM methodology and other ICTs.

Learning outcomes:

1. To carry out a SOA in a specific field of knowledge including references to relevant sources of information.
2. To be familiar with the main funding mechanisms for research in EU and to be able to fulfil the requirements from a specific call
3. To be familiar with the main instruments of intellectual property (IP) and to know the main specifications concerning IP.
4. To be able to propose a test campaign to prove a hypothesis, selecting the adequate test procedures, using the Design of Experiments technique to optimise its number, and developing relevant regression models.
5. To be able to develop a research proposal to submit to a call, including a SOA, a list of activities, a test campaign, a budget and a chronogram.

6. To be familiar with the new challenges in material & technologies and in cities & infrastructures analysing future potential markets and jobs.
7. To be familiar with the new challenges in ICT & project management analysing future potential markets and jobs.

Content:

Unit 1. Introduction to research, sources of information, referencing and state of the art.
Unit 2. Funding mechanisms for research within Europe. Call requirements.
Unit 3. Intellectual property: copyright and industrial property (trademarks, design models, patents). Specifications that regulates their implementation and use.
Unit 4. Test campaigns. Definition of relevant properties to be measured, selection of standard test, determination of influencing variables, definition of the number of test to be carried out using DOE (Design of Experiments), determination of adequate regression models.
Unit 5. Structure of a research proposal: Objectives, state of the art, activities, budget, chronogram.
Unit 6. New challenges in material & technologies and in cities & infrastructures. Future potential markets and jobs.
Unit 7. New capabilities and effects of ICT (Information and Communication Technologies) in Information processing and project management in civil engineering. Future potential markets and jobs in a common data environment.

Teaching methodology:

The theoretical hours are used to introduce the main concepts of the different topics covered in the program. The practical hours will include exercises/workshops/jobs, to be solved individually or in groups, on some topic that the students will have to analyze and discuss, sometimes using specific software. These practical hours will be carried out under the supervision of the teacher. In addition, students will have to dedicate personal self-directed time to finish exercises/workshops/jobs under specific deadlines.

Training activities:

	Number of hours	% Attendance
Theory	30	100
Classroom practice	30	100
Tutorials	5	100
Evaluation	5	100
Group work	30	0
Self-directed work	50	0

Assessment method:

	Minimum weighting	Maximum weight
Continuous classroom evaluation	0%	15%
Final written work	30%	50%
Oral presentation	0%	10%
Theoretical exam	0%	25%
Practical exercises	30%	50%

Grading system:

U.PORTO	20	19	18	17	16	15	14	13	12	11	10	9	...	0
Portugal	Very Good with distinction			Good with distinction		Good		Sufficient				Fail		
U.CANTABRIA	10.0	9.9	9.0	8.9	...		7.0	6.9	...		5.0	4.9	...	0.0
Spain	Sobresaliente			Notable				Aprobado				Suspenso		
THM	100	...	88	87	73	72	58	57	...		50	49	...	0
Germany	Excellent			Good with distinction		Satisfactory		Sufficient				Fail		

Bibliography:

EU Funding mechanisms (HORIZON 2020): http://ec.europa.eu/programmes/horizon2020/
EU Funding mechanisms (LIFE +): http://ec.europa.eu/environment/life/project/Projects/
International Patent Office: http://www.wipo.int/portal/en/index.html
EU standards database: http://esearch.cen.eu/esearch/
International standards database http://www.iso.org/iso/catalogue_ics
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Bew, M., et al (2008). eWork and eBusiness in Architecture, Engineering and Construction: ECPPM 2008, in: eWork and eBusiness in Architecture, Engineering and Construction. ECCPM 2008, CRC Press.
Björk, B.-C., Penttilä, H., (1989). A scenario for the development and implementation of a building product model standard. Adv. Eng. Softw. 1978 11, 176–187.
Bjorkhaug, L., (2003). Use of building product models and reference data libraries for project and quality management, in: International Conference on Construction Project Management Systems: The Challenge of Integration, (CIB W99). in-house publishing, Rotterdam (Netherlands), p. approx. 9 p.
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